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Review

Implementation of fall prevention in residential care facilities: A systematic review of barriers and facilitators

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ABSTRACT

Objectives: To identify the barriers and facilitators for fall prevention implementation in residential care facilities.
Design: Systematic review. Review registration number on PROSPERO: CRD42013004655.
Data sources: Two independent reviewers systematically searched five databases (i.e. MEDLINE, EMBASE, CINAHL, PsycINFO, and Web of Science) and the reference lists of relevant articles.
Review methods: This systematic review was conducted in line with the Center for Reviews and Dissemination Handbook and reported according to the PRISMA guideline. Only original research focusing on determinants of fall prevention implementation in residential care facilities was included. We used the Mixed Method Appraisal Tool for quality appraisal. Thematic analysis was performed for qualitative data; quantitative data were analyzed descriptively. To synthesize the results, we used the framework of Grol and colleagues that describes six healthcare levels wherein implementation barriers and facilitators can be identified.
Results: We found eight relevant studies, identifying 44 determinants that influence implementation. Of these, 17 were facilitators and 27 were barriers. Results indicated that the social and organizational levels have the greatest number of influencing factors (9 and 14, respectively), whereas resident and economical/political levels have the least (3 and 4, respectively). The most cited facilitators were good communication and facility equipment availability, while staff feeling overwhelmed, helpless, frustrated and concerned about their ability to control fall management, staffing issues, limited knowledge and skills (i.e., general clinical skill deficiencies, poor fall management skills or lack of computer skills); and poor communication were the most cited barriers.
Conclusion: Successful implementation of fall prevention depends on many factors across different healthcare levels. The focus of implementation interventions, however, should be on modifiable barriers and facilitators such as communication, knowledge, and skills. Effective fall prevention must consist of multifactorial interventions that target each resident's fall risk profile, and should be tailored to overcome context-specific barriers and put into action the identified facilitators.

What is already known about the topic?

- Multifactorial interventions, tailored to each resident's fall risk profile, can reduce the number of falls and recurrent fallers under highly controlled circumstances, but seems to be ineffective under "real-world" conditions, presumably due to poor implementation.
- Successful implementation of complex, multifactorial interventions in clinical practice involves a tailored, multifaceted approach based on a good understanding of barriers and facilitators for implementation. No reviews exist that comprehensively summarize the evidence on fall prevention implementation barriers and facilitators in residential care settings.

What this paper adds

- Seventeen facilitators and 27 barriers that influenced the implementation of fall prevention were identified across different healthcare levels. The social and organizational levels

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have the greatest number of influencing factors, whereas resident and economical/political levels have the least.
- Most cited facilitators were good communication and facility equipment availability, while staff feeling overwhelmed, helpless, frustrated and concerned about their ability to control fall management, staffing issues, limited knowledge and skills; and poor communication were the most cited barriers.
- Effective fall prevention should be tailored to overcome context-specific barriers and put into action the identified facilitators.

1. Introduction

With an estimated incidence of 1.6 falls per person-year, falls are gaining increased attention in residential care facilities (Rapp et al., 2012). Although most falls result in minor injuries, 63.5% of annual accidental deaths in those older than 75 in the USA are caused by falls (National Center for Injury Prevention and Control, 2015). A recent study stated that 89.1% of external cause deaths of nursing home residents were due to falls (Ibrahim et al., 2015). Besides physical complications, falls lead to psychological consequences, such as fear of falling, depression, and social isolation (Kannus et al., 2005; Rubenstein and Josephson, 2002). Furthermore, falls are associated with extensive healthcare costs (Burns et al., 2016).

Over the years, many preventive actions have been tested in residential care facilities (Cameron et al., 2012; Oliver et al., 2007; Vlaeyen et al., 2015). A recent *meta*-analysis states that multifactorial interventions, tailored to each resident's fall risk profile, can significantly reduce the number of falls and recurrent fallers (Vlaeyen et al., 2015). However, this *meta*-analysis reviewed interventions performed under highly controlled circumstances (i.e., randomized controlled trials) which may overestimate an intervention's effect when implemented in clinical practice, under "real-world" conditions. So, although a highly controlled trial maximizes the likelihood of observing an intervention effect if one exists, different healthcare level factors, such as factors related to the resident, the provider or the system, may moderate an intervention's effect (Singal and Waljee, 2014).

To facilitate implementation and gain insights into the mechanisms by which implementation is likely to succeed, the need to establish theoretical bases of implementation strategies is widely recognized. Implementation science, therefore, progressed towards an abundant use of theoretical approaches (e.g., implementation theories, models or frameworks) aimed to: (1) describe/guide the process of implementation, (2) understand/explain what influences implementation outcomes, or (3) evaluate implementation. To understand and explain what influences implementation outcomes, determinant frameworks (i.e., frameworks that describe general types of influencing determinants, typically comprised a number of individual barriers and/or facilitators) can be used (Nilsen, 2015). These determinant frameworks suggest that successful implementation of complex, multifactorial interventions in clinical practice involves a tailored, multifaceted approach based on a good understanding of barriers and facilitators for implementation (Grol, 1997; Nilsen, 2015). Unfortunately, no reviews exist that comprehensively summarize the evidence on fall prevention implementation barriers and facilitators in residential care settings. Only two reviews addressed older persons' perception of fall prevention, which is just one factor of implementation (Bunn et al., 2008; McInnes and Askie, 2004). Another narrative review investigated fall prevention effectiveness and reported implementation barriers of included articles, but failed to consider facilitators (Neyens et al., 2011). It would be valuable to also know which factors are the drivers of success. Therefore, the present systematic review aims to identify fall prevention implementation barriers and facilitators in residential care facilities.

2. Methods

This systematic review was conducted in line with the Center for Reviews and Dissemination Handbook for undertaking review in health care and reported according to the PRISMA guideline (Centre for Reviews and Dissemination, 2009; Liberati et al., 2009; Moher et al., 2009). The protocol was registered in the PROSPERO database (ID# CRD42013004655) (PROSPERO, 2016).

2.1. Search strategy

A systematic literature search was performed using five electronic databases from inception to August 2016: MEDLINE, EMBASE, CINAHL, PsycINFO, and Web of Science. Both MeSH terms and "free" search terms were combined with Boolean operators and adapted for each database to build a search string (see Fig. 1).

Search Query
Search ("Accidental Falls"[Mesh]OR "Fall prevention" OR "Fall") AND ("Nursing Homes"[Mesh] OR "Homes for the Aged"[Mesh] OR "Residential Facilities"[Mesh] OR "Long-Term Care"[Mesh] OR "Institutionalization"[Mesh] OR "Rest home*" OR "Retirement facilities" OR "Retirement home*") AND ("Health Plan Implementation"[Mesh] OR "Program Evaluation"[Mesh] OR "Information Dissemination"[Mesh] OR "Attitude of Health Personnel"[Mesh] OR "Organizational Innovation"[Mesh] OR "Health Behavior"[Mesh] OR "Guideline Adherence"[Mesh] OR "Health Knowledge, Attitudes, Practice"[Mesh] OR "Motivation"[Mesh] OR "Quality Improvement"[Mesh] OR "Feasibility Studies"[Mesh] OR "Process Assessment (Health Care)"[Mesh] OR "Implement*" OR "Integrat*" OR "Research utilization" OR "Disseminat*" OR "Manage*" OR "Adopt*" OR "Uptake" OR "Evaluat*" OR "Reduce*" OR "Prevent*" OR "Translat*" OR "Motivators" OR "Barrier*" OR "Facilitat*" OR "Influencing factor*" OR "Influenc*" OR "Improv*" OR "Awareness" OR "Perspective*" OR "Knowledge transfer" OR "Complian*" OR "Challenge*" OR "Feasibility" OR "Motivat*" OR "Behavior" OR "Behavioral change" OR "Skill*" OR "Conflict" OR "Attitude" OR "Norm" OR "Self-efficacy" OR "Abilities" OR "Adherence")

Fig 1. Search strategy used for MEDLINE (OVID) and adapted for Embase, CINAHL, PsycINFO, and Web of Science.

In addition, the reference lists of all included articles were screened for additional relevant articles.

2.2. Inclusion and exclusion criteria

Eligible publications had to meet all of the following criteria: (1) original research aimed primarily or secondarily at fall prevention implementation barriers or facilitators (e.g. effectiveness trials, i.e. pragmatic studies examining interventions under circumstances that approach real-world practice and deliver in routine clinical settings (Singal and Waljee, 2014)); (2) research conducted in residential care facilities (if studies investigated both residential care facilities and a different setting, they were included only if results for residential care facilities were reported separately); (3) published in peer-reviewed journals; (4) written in English, Dutch, French or German. Studies were excluded if they: (1) reported barriers and facilitators only in the discussion section (e.g., RCTs that reported on intervention effectiveness but that did not investigate the determinants of successful or failed clinical implementation); (2) were conducted in hospitals, the community, service flats, or assisted-living facilities; (3) were efficacy trials (i.e. investigate the benefits and harms of an intervention under highly controlled conditions (Singal and Waljee, 2014)), editorials, comments, or letters to the editor.

For this systematic review, the following definitions were used: (1) barriers are any actual or perceived factors that interfere with a change intervention (RNAO, 2012); (2) facilitators are factors that would promote or help implement shared decision making in clinical practice (RNAO, 2012); (3) residential care facilities are long-term care facilities that provide supervision and assistance in activities of daily living, with medical and nursing services when required (NCBI, 2015); (4) implementation is the systematic uptake of research findings and other evidence-based practices into routine practice to improve the quality and effectiveness of health services and care (Nilsen, 2015).

2.3. Study selection

First, two reviewers (EV and JS) screened titles and abstracts independently against the inclusion and exclusion criteria. Subsequently, the full text of potentially relevant references was assessed. Disagreement about eligibility was resolved through discussion and consensus with the additional reviewers (KM, EvdE, GL, EJ, ED, FD).

2.4. Data extraction

Two reviewers (EV and JS) used a form to guide data extraction. This form was first piloted and revised accordingly in order to independently extract the following data: (1) general study information (e.g., first author, publication year, setting); (2) study aim and methods (e.g., data collection method, sample size and characteristics); (3) research outcome (i.e., fall prevention implementation barriers and facilitators); (4) risk of bias criteria.

2.5. Quality appraisal

Three reviewers (EV, JS, and either GL, EJ, or EvdE) independently assessed the methodological quality of the included studies. The Mixed Method Appraisal Tool (MMAT) was used, since the selected studies had various kinds of designs (Pluye et al., 2009). The MMAT consists of three quality criteria sets for qualitative, quantitative, and mixed-methods studies. Relevant quality criteria for each included study were evaluated and scored as "Yes" if criteria were clearly met; "No" if criteria were clearly not met; "Unclear" if it was unclear if criteria were met; and "NA" if criteria were not applicable. The studies were ranked as having low (yes: <3), moderate (yes: 3–4), or high quality (yes: >4). Disagreement between the reviewers was resolved through discussion and consensus within the research team.

2.6. Data analysis and synthesis

For qualitative data, thematic analysis was conducted. Two reviewers (EV and JS) compared the themes from each study until consensus was reached. Original study quotes were used to illustrate the themes (Lucas et al., 2007). Quantitative data were analyzed descriptively (raw numbers, means, and percentages). The framework of Grol and colleagues (Grol and Grimshaw, 2003; Grol and Wensing, 2004) was used to synthesize the results. This

Table 1
Summary of Results Analyzed According to the Implementation Process Levels of Grol and collagues.

Process level *(level of description)*	Barriers	Facilitators
Innovation *attractiveness, credibility, and feasibility of the innovation (i.e., guideline or intervention that is perceived as new)*	1) Too difficult (2/8 studies[a])(Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007) Quote Licensed practical nurse : *"Now, if [protocols] were technical and difficult for a layperson to read, then they weren't useful to me."*(Colon-Emeric et al., 2007) 2) Not developed in view of context (2/8 studies) (Colon-Emeric et al., 2007; Etheridge et al., 2014) 3) Too long (1/8 studies)(Resnick et al., 2004) 4) Not user-friendly (1/8 studies)(Resnick et al., 2004) 5) Absence of measurable outcomes (1/8 studies)(Etheridge et al., 2014)	1) Good credibility, way to promote evidence based practice, keep up-to-date with progress in a field (3/8 studies)(Capezuti et al., 2007; Colon-Emeric et al., 2007; Resnick et al., 2004) Quote Nurse practitioner: *"I think it is better to do stuff that has been proven to be effective . . . rather than just doing them because that's the way everybody used to do it."*(Colon-Emeric et al., 2007) 2) Provide tools for implementation (2/8 studies)(Chapman and Newenhouse, 2013; Resnick et al., 2004) Quote Director of nursing: *"Getting prepared to implement them (i.e., the guidelines); 'tooling them' by developing tools for each guideline as each one is different and unique."*(Resnick et al., 2004)
Individual **professional** *awareness, knowledge, attitude, motivation of the individual professional toward the intervention*	1) Staff feeling helpless, frustrated, and concerned about ability to control fall management; overwhelmed by excess protocols and required training (6/8 studies)(Capezuti et al., 2007; Colon-Emeric et al., 2007, 2014; Etheridge et al., 2014; Wagner et al., 2010; Williams et al., 2011) Quote Staff development nurse: *"Sometimes they get a little too much overload. You got guidelines for care plans, tube feedings, [tracheostomy] care, HIPAA, OSHA, dysphagia protocol*	1) Raising awareness and interest (3/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2014) Quote Licensed practical nurse: *"A lot of the falls policies that we were learning we already had in place, but it's still that re-educating and reminding everybody of these things."*(Colon-Emeric et al., 2014) 2) Sense-making to understand underlying fall causes (1/8

Table 1 (*Continued*)

Process level *(level of description)*	Barriers	Facilitators
	. . . "(Colon-Emeric et al., 2007) 2) Limited knowledge and skills (5/8 studies): limited general education or health literacy, (Colon-Emeric et al., 2007; Resnick et al., 2004) knowledge deficit of quality improvement processes, (Wagner et al., 2010) poor falls management(Chapman and Newenhouse, 2013) and computer skills(Capezuti et al., 2007; Chapman and Newenhouse, 2013) Quote Personal support worker: *"I think knowledge is the number one thing . . . We don't have meetings about [falls]. This is the first time that anybody has ever come in and talked to us about . . . [a] focus on falls . . . "*(Wagner et al., 2010) 3) Negative beliefs and attitudes (4/8 studies): guidelines perceived as replacing clinical judgement, (Colon-Emeric et al., 2007) falls perceived as inevitable and not preventable (Chapman and Newenhouse, 2013; Wagner et al., 2010; Williams et al., 2011) Quote Physician: *"Protocols are great and all, but the specific milieu varies from patient to patient. I know what I need to focus on for each patient."*(Colon-Emeric et al., 2007) Quote Personal support worker: *"Every day I walk on the floor and somebody's always falling left, right, and center. There's no way to preventing it."*(Wagner et al., 2010) 4) Low awareness (1/8 studies)(Colon-Emeric et al., 2007)	studies)(Colon-Emeric et al., 2014) 3) Staff being motivated to learn and use skills regularly (1/8 studies)(Resnick et al., 2004)
Resident *residents' motivation and compliance*	1) Resident/family noncompliance (2/8 studies)(Chapman and Newenhouse, 2013; Wagner et al., 2010) Quote Nurse supervisor: *"It's not that we don't know [hip protectors] are effective, we just don't have many [residents] that will wear them."*(Wagner et al., 2010) 2) Conflict with resident/family goals or expectations (1/8 studies)(Colon-Emeric et al., 2007) 3) Resident boredom (1/8 studies)(Wagner et al., 2010)	Not available
Social context *teamwork, leadership, and support from colleagues*	1) Poor communication (5/8 studies): poor information transfer between care providers/shifts(Colon-Emeric et al., 2007, 2014; Wagner et al., 2010) and between staff/family (Wagner et al., 2010), lack of care plan communication, (Chapman and Newenhouse, 2013; Wagner et al., 2010) failure to communicate falls(Wagner et al., 2010) or training information, (Resnick et al., 2004) and communication tension/hostility between licensed staff and unlicensed staff (Wagner et al., 2010) Quote Licensed practical nurse: *"It doesn't do a whole lot of good if one shift is really working hard on trying to put things in place to keep a patient from falling or reduce the number of times that they fall if nobody else is following through. I think that one thing that we need is shift to shift; if we come up with an idea to make sure that it is followed through by other people and that the whole crew is involved."*(Colon-Emeric et al., 2014) 2) Lack of "buy-in" and accountability (3/8 studies)(Chapman and Newenhouse, 2013; Etheridge et al., 2014; Resnick et al., 2004) Quote Change user: *"They put it together, they developed it. Then, they dropped it on us. [. . .] They said: 'Do what you have to do to make it work.'"*(Etheridge et al., 2014) 3) Leadership lacking quality improvement skills, without listening to and learned from staff or not providing support (3/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Etheridge et al., 2014) 4) Clinical leaders asked to assume other leadership roles, adding to high workload (1/8 studies)(Capezuti et al., 2007)	1) Good communication (4/8 studies): sharing information across shifts/disciplines(Chapman and Newenhouse, 2013; Colon-Emeric et al., 2014; Resnick et al., 2004) and between staff/family, (Wagner et al., 2010) communicating care plan, (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2014; Wagner et al., 2010) active listening and addressing communication weakness, (Colon-Emeric et al., 2014) and using diverse communication strategies Quote Department head: *"So the communication got to the point where it is at a much higher level, that we are focusing our communication not just on talking, but we are actually handing off valuable information that can prevent falls, that does prevent falls."*(Colon-Emeric et al., 2014) 2) Staff involvement and empowerment (3/8 studies)(Colon-Emeric et al., 2007, 2014; Resnick et al., 2004) Quote Housekeeper: *"In the beginning . . . it was like, 'why is she making us go to these meetings?' Cause I'm figuring, I mean seriously, I'm a housekeeper, what do you need me for? And I'm laundry, so why? But after we got into [the program], it was like, 'Oh, I am a piece of this puzzle. We are!' Because I really didn't think that we were."*(Colon-Emeric et al., 2014) 3) Collaboration, teamwork, (Capezuti et al., 2007; Colon-Emeric et al., 2014; Wagner et al., 2010) and sharing responsibility(Colon-Emeric et al., 2014) (3/8 studies) Quote Control licensed practical nurse: *"Now that I'm part of this team my opinion counts. I'm being educated on what I need to do and with this falls committee we can take it another step further . . . "*(Colon-Emeric et al., 2014) 4) Leaders who involve staff, who clearly explain rationale, and provide support (3/8 studies)(Chapman and Newenhouse, 2013; Colon-Emeric et al., 2014; Resnick et al., 2004) Quote Control department head: *"So, trying to get our recommendations down to them [frontline staff] and also trying to be welcoming that we want their opinions as well because we each have our own specialty and, you know, they should know their patients best."*(Colon-Emeric et al., 2014) 5) Presence of clinical leaders (1/8 studies)(Capezuti et al., 2007)

Table 1 (*Continued*)

Process level *(level of description)*	Barriers	Facilitators
Context organization *availability of resources, staffing, and support from the management*	1) Staffing issues (6/8 studies), (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Resnick et al., 2004; Wagner et al., 2010; Williams et al., 2011) e.g., high turnover in staff having clinical and administrative functions, many float pool staff, or lack of physical and occupational therapists Quote Personal support worker: *"You can't help them from falling if there's only one staff . . . "*(Wagner et al., 2010) Quote Director of care: *"My wish list is for a physio aide to work under the direction of a physiotherapist. And she could give exercises, set up programs, and that person could work here Monday to Friday and make sure that the ones that need to be walked more would be walked . . . "*(Williams et al., 2011) 2) Lack of time (4/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Williams et al., 2011) 3) Limited facility equipment (4/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Wagner et al., 2010) Quote Staff development nurse: "Patient comes in . . . has high risk for falls. Some of us might think that the patient needs a [low] bed, but we don't have any [low] beds in the building."(Colon-Emeric et al., 2007) 4) Prioritizing other tasks (4/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Etheridge et al., 2014) Quote Change manager: *"Meetings gave way to other topics, like patient-centered care, and the falls program was no longer on the agenda."*(Etheridge et al., 2014) 5) Lack of educational structures (4/8 studies)(Chapman and Newenhouse, 2013; Etheridge et al., 2014; Resnick et al., 2004; Williams et al., 2011) 6) Lack of quality improvement structures (3/8 studies) (Capezuti et al., 2007; Wagner et al., 2010; Williams et al., 2011) Quote Registered nurse on retroactive actions: *"If there is an increase . . . in the number of falls [and] if a resident would have fallen . . . [we] discuss what's going on, and what we can do."*(Wagner et al., 2010) 7) No adequate structural support for fall prevention coordinator (2/8 studies)(Capezuti et al., 2007) 8) Workload (2/8 studies): intervention maintenance and documentation burden(Colon-Emeric et al., 2007; Resnick et al., 2004) Quote Director of nursing: *"I would say documentation is our biggest challenge: to keep up with all the demands of documentation. It just is so stringent. There are so many demands for documentation: for assessing, for follow-up, for writing down, for contacting various groups, for letting people know what is happening . . . "*(Resnick et al., 2004)	1) Facility equipment availability (4/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Wagner et al., 2010) 2) Prioritization and strong interest in fall prevention (3/8 studies)(Capezuti et al., 2007; Chapman and Newenhouse, 2013; Resnick et al., 2004) 3) Existence of educational structures (3/8 studies)(Capezuti et al., 2007; Colon-Emeric et al., 2014; Wagner et al., 2010) Quote Certified nursing assistant: *"I learned as a group. We would all get together, everybody will come up with their different ideas; you know, 'take their medicine'. I'd say, 'the restorative program', 'trying to get them toileted every two hours.' A combination of everything that will work by all of us getting together and putting out our ideas."*(Colon-Emeric et al., 2014) 4) Quality improvement structures (2/8 studies)(Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007) Quote Director of nursing: *"I know we have had benefits! Implementation decreased our falls by like almost 50% and I believe we evaluate our falls in a more timely manner and I think we get better results that way . . . "*(Resnick et al., 2004) 5) Formal appointment of a fall prevention coordinator supported by a multidisciplinary team (1/8 studies)(Resnick et al., 2004) 6) Safety culture (1/8 studies)(Colon-Emeric et al., 2014)
Economic & political context *financial arrangements and policies*	1) Interpretations concerning regulations restricting access to the care plan (2/8 studies)(Colon-Emeric et al., 2007; Wagner et al., 2010) Quote Certified nursing assistant: *"There are a lot of people that don't think certified nursing assistants need to know [the residents' diagnoses], but I think we do. I think that helps us to deal with them . . . When I was in orientation, I was told we didn't have the authority to look at the resident's charts. It is confidential."*(Colon-Emeric et al., 2007) 2) Lack of reimbursement (1/8 studies)(Capezuti et al., 2007) 3) Corporate and/or state mandates if initiated unexpectedly (1/8 studies)(Etheridge et al., 2014) Quote Change user: *"It fell from the sky. Someone suddenly appeared with a falls prevention program."*(Etheridge et al., 2014)	1) Corporate and/or state mandates (2/8 studies)(Capezuti et al., 2007; Colon-Emeric et al., 2007) Quote Interviewer: *"Has [your facility] decided to use any practice guidelines?" Director of nursing: "Yeah. We have to do the policies and procedures [that come from] the company."*(Colon-Emeric et al., 2007)
Total number of influencing factors: n = 44	**Total number of barriers identified: n = 27**	**Total number of facilitators identified: n = 17**

[a] Number of articles that report the determinant/total number of studies in the systematic review.

framework describes six healthcare levels where implementation barriers and facilitators can be identified: (1) the innovation, (2) the individual professional, (3) the resident, (4) the social context, (5) the organizational context, and (6) the economic and political context. A more detailed description of each level can be found in Table 1 (Grol and Grimshaw, 2003; Grol and Wensing, 2004).

3. Results

3.1. Search strategy

Fig. 2 shows a flow diagram of the steps taken to identify relevant articles. In total, we identified eight articles that met the inclusion criteria (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007, 2014; Etheridge et al., 2014; Resnick et al., 2004; Wagner et al., 2010; Williams et al., 2011).

3.2. Study characteristics

Study characteristics and methodology are presented in Table 2. Five studies were conducted in the USA (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007, 2014; Resnick et al., 2004), and three in Canada (Etheridge et al., 2014; Wagner et al., 2010; Williams et al., 2011). There were six qualitative (Capezuti et al., 2007; Colon-Emeric et al., 2007, 2014; Etheridge et al., 2014; Wagner et al., 2010; Williams et al., 2011), one quantitative (Chapman and Newenhouse, 2013), and one mixed-method study design (Resnick et al., 2004). Two studies examined a specific intervention component (i.e., the communication process (Colon-Emeric et al., 2014; Wagner et al., 2010), and the learning climate (Colon-Emeric et al., 2014)). No articles reported operational definitions of barriers or facilitators, but four studies based their analysis on a theoretical approach (Capezuti et al., 2007; Colon-Emeric et al., 2007; Etheridge et al., 2014; Wagner et al., 2010). Three studies looked at determinants of newly implemented fall prevention interventions (Capezuti et al., 2007; Colon-Emeric et al., 2014; Resnick et al., 2004); the other five reported on current fall prevention interventions (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Etheridge et al., 2014; Wagner et al., 2010; Williams et al., 2011).

3.3. Study quality

Overall, the methodological quality was low to fair (Table 3). No qualitative studies provided adequate and clear information about the use of triangulation or member checking. The quantitative study failed to meet criteria for adequate sample representation, response rate, and measurements appropriateness (Chapman and Newenhouse, 2013).

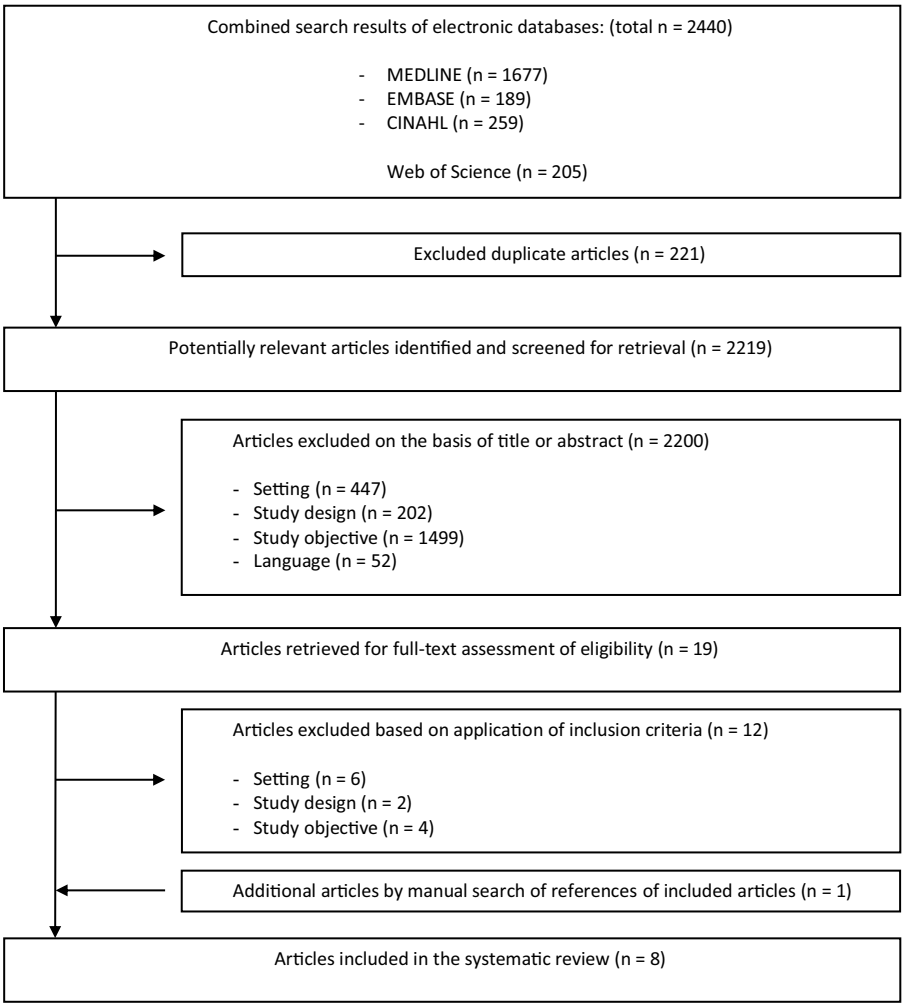

Fig. 2. Flow diagram for article selection.

Table 2
Study Characteristics of the Included Articles.

Author/Year	Study Design	Study Methods	Setting	Participants	Data analysis
(Capezuti et al., 2007)	Qualitative	Focused interviews (n = 2) supplemented with narrative logs and documentation of interactions between APNs and staff	4 NHs in a large south-eastern metropolitan area, USA Characteristics: - Demographic: 2 suburban and 2 urban - NH type: 3 nonprofit and 1 profit - Bed size range: 120–200	2 APNs Characteristics: - Master's prepared nurses - 15 years nursing experience - ≥5 years experience in LTCF direct practice, administrative, research, or all positions	Content analysis Theoretical approach: Conceptual framework "Speeding the adoption of innovative health care programs" Bradley et al. (Bradley et al., 2004)
(Chapman and Newenhouse, 2013)	Quantitative	Mail survey (Dillman method (Dillman, 2006)) (n = 39)	43 NHs in Wisconsin, USA Characteristics: - Demographic: 22 NHs rural and 21 NHs urban	- NH administrators and directors of nursing Characteristics: NR	Descriptive analysis (raw numbers, means and percentages) Theoretical approach: NR
(Colon-Emeric et al., 2014)	Qualitative	Focus groups (n = 16)	8 NHs in North Carolina and Virginia, USA Characteristics: - Demographic: urban - NH type: 4 community and 4 Veterans Affairs NHs - Bed size range ≥ 90 - Care provided: post-acute skilled nursing/rehabilitation services and long-term care	77 staff members, including: nursing assistants, direct care nurse, administrator, housekeeping, medical staff, rehabilitation and others Characteristics: - Female: 82% - Age: majority between 36 and 55 years	Framework analysis with 6 key stages: (1) familiarization; (2) identification of thematic framework (topics in interview guide used as thematic framework to develop core set of a priori codes); (3) indexing; (4) charting; (5) mapping; (6) interpretation Theoretical approach: NR
(Colon-Emeric et al., 2007)	Qualitative	In depth interviews (n = 35)	4 NHs in North Carolina, USA Characteristics: - NH type: community NHs - Bed size range: 70–200	36 staff members, including: medical directors (n = 3); staff physicians (n = 1); nurse practitioners (n = 2); director of nursing (n = 3); assistant director of nursing (n = 1); administrative nurses (quality assurance nurses, staff development nurses or nurse supervisors) (n = 4); floor nurses (n = 10); certified nursing assistants (n = 11); medication technician (n = 1) Characteristics: NR	Conceptual/thematic description Theoretical approach: the stages of adoption from Rogers' Diffusion of Innovation model (Rogers, 2003)
(Etheridge et al., 2014)	Qualitative	In depth interviews (n = 4)	1 LFCF in Québec, Canada Characteristics: - Demographic: urban - Bed size: 42 - Resident type: mobile and elder	4 staff members, including 2 change manager and 2 change users (not further specified) Characteristics: NR	Process-focused coding, inspired by grounded theory Theoretical approach: Self-developed framework (Greenhalgh et al., 2004)
(Resnick et al., 2004)	Mixed methods[a]	In depth interviews (n = 20)	23 LTCFs in Maryland, USA Characteristics: NR	20 directors of nursing Characteristics: NR	Content analysis Theoretical approach: NR
(Wagner et al., 2010)	Qualitative	Focus groups (n = 8)	4 LTCFs in Ontario, Canada Characteristics: - Demographic: suburban - Bed size range: 120–169 - Care provided: intermediate-level nursing care - Resident type: medically stable with physical and cognitive impairments	41 staff members, including: licensed staff (registered nurses and registered practical nurses) (n = 20), unlicensed staff (personal support workers) (n = 21). Characteristics: - Female: n = 34 - Average age range: 46–55	Focus group methodology by Krueger et al. (Krueger, 1994) Theoretical approach: Quality of Care Framework (Donabedian, 1966)
(Williams et al., 2011)	Qualitative	Focus groups (n = 11) and in depth interviews (n = 28)	7 LTCFs in 2 mid-size cities, Canada Characteristics: - Demographic: nearby rural areas affiliated with 2 health regions - NH type: Government-run, public sector - Bed size range: 36–273 - Care provided: nursing and personal care on a 24-h basis	98 staff members, including: - Focus groups (n = 72): licensed nurses (n = 25); special care aids (unlicensed care providers) (n = 47) - Interviews (n = 26): occupational and physiotherapy workers (n = 6); dietary aides (n = 5); physicians (n = 2); directors of care (n = 6); administrators (n = 5); and others (n = 2) Characteristics: - Female: 91% - Average age: 46.08 (SD = 10.52)	Thematic content analysis Theoretical approach: NR

APN, Advanced Practice Nurse; NH, nursing home; LTCF, long term care facility; NR, not reported.
[a] Only qualitative component used for this review.

Table 3
Methodological Quality.

Types of mixed-methods study components or primary studies	Methodological quality criteria	Capezuti et al. (2007)	Chapman and Newenhouse (2013)	Colon-Emeric et al. (2014)	Colon-Emeric et al. (2007)	Etheridge et al. (2014)	Resnick et al., 2004)[a]	Wagner et al. (2010)	Williams et al. (2011)
Screening **questions**	Are there clear qualitative and quantitative research questions (or objectives), or a clear mixed-methods question (or objective)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Do the collected data allow address the research question (objective) e.g., consider whether the follow-up period is long enough for the outcome to occur (for longitudinal studies or study components)?	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
1. Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	Yes	NA	Yes	Yes	Unclear	Yes	Yes	Yes
	1.2. Is the process for analyzing qualitative data relevant to address the research question (objective)?	Yes	NA	Yes	Yes	Unclear	Yes	Yes	Yes
	1.3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	Unclear	NA	Unclear	Unclear	No	Unclear	Unclear	Unclear
	1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	Unclear	NA	Unclear	Unclear	No	Unclear	Unclear	Unclear
2. Quantitative (descriptive)	2.1. Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed-methods question)?	NA	Yes	NA	NA	NA	/	NA	NA
	2.2. Is the sample representative of the population understudy?	NA	No	NA	NA	NA	/	NA	NA
	2.3. Are measurements appropriate (clear origin, or validity known, or standard instrument)?	NA	Unclear	NA	NA	NA	/	NA	NA
	2.4. Is there an acceptable response rate (60% or above)?	NA	No	NA	NA	NA	/	NA	NA
3. **Mixed Method**	3.1. Is the mixed-methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed-methods question (or objective)?	NA	NA	NA	NA	NA	/	NA	NA
	3.2. Is the integration of qualitative and quantitative data (or results) relevant to address the research question (objective)?	NA	NA	NA	NA	NA	/	NA	NA
	3.3. Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results) in a triangulation design?	NA	NA	NA	NA	NA	/	NA	NA

NA, not applicable.
[a] Since only the qualitative component was used for this review, the study was viewed as qualitative study for the analysis.

3.4. Synthesis of results

We identified 44 determinants that influenced implementation, including 17 facilitators and 27 barriers across the six healthcare levels described by Grol and colleagues (Grol and Grimshaw, 2003; Grol and Wensing, 2004). We reported the determinants per level in order of frequency that they were reported in the original included studies and added original study quotes to illustrate the themes in Table 1.

3.4.1. Innovation level

Several barriers were identified: the innovation being too difficult (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007), not developed in view of the context (Colon-Emeric et al., 2007; Etheridge et al., 2014), too long (Resnick et al., 2004), not user-friendly (Resnick et al., 2004), or missing measurable process outcomes (Etheridge et al., 2014). By contrast, the following factors were identified as facilitators: seeing an intervention as a way to promote evidence-based practice, and to keep up-to-date with progress in a field (Capezuti et al., 2007; Colon-Emeric et al., 2007; Resnick et al., 2004); and timely provision of stepwise guideline implementation tools (Chapman and Newenhouse, 2013; Resnick et al., 2004).

3.4.2. Individual professional level

The most cited determinant identified at the individual professional level was staff often felt helpless, frustrated, and concerned about their ability to control fall management, which could cause stress and anxiety (Wagner et al., 2010; Williams et al., 2011). In addition, the staff felt overwhelmed by excessive protocols on top of related information and extra training required (Capezuti et al., 2007; Colon-Emeric et al., 2007; Etheridge et al., 2014).

Also important are the following knowledge and skills barriers: limited general education or health literacy among staff having a low-level educational background (Colon-Emeric et al., 2007; Resnick et al., 2004); knowledge deficit of quality improvement processes (e.g., care plans and their purpose) (Wagner et al., 2010); poor falls management skills (e.g. administering assessment tools) (Chapman and Newenhouse, 2013); and lack of computer skills to analyze fall data (Capezuti et al., 2007; Chapman and Newenhouse, 2013).

Negative beliefs and attitudes toward guidelines, in general, or falls and fall prevention, in particular, hindered implementation. Some staff members believed that guidelines led to "cookbook medicine," replacing clinical judgment, and therefore are not compatible with resident-centered care (Colon-Emeric et al., 2007). Furthermore, falls were often considered as being inevitable and thus were perceived as not being preventable (Chapman and Newenhouse, 2013; Wagner et al., 2010; Williams et al., 2011). In the quantitative survey study by Chapman and Newenhouse, eighty percent of respondents confirmed this statement (Chapman and Newenhouse, 2013).

Awareness of fall prevention among resident care staff influenced implementation (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007, 2014; Wagner et al., 2010). Colón-Emeric and colleagues (Colon-Emeric et al., 2007) reported that staff was often unaware of guidelines; confusion with other documents such as standing orders, incident reports, or manuals was common. Conversely, by raising fall prevention awareness, a strong interest of the staff in playing an active role was identified (Capezuti et al., 2007). Seeking to understand underlying causes for falls by means of "sense-making" (Colon-Emeric et al., 2014) and staff being motivated to learn and use skills regularly (Resnick et al., 2004) were perceived as additional facilitators.

3.4.3. Resident level

Noncompliance to recommendations or conflicts with expectations and goals, of either the residents or their families complicated implementation (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Wagner et al., 2010). In addition, resident boredom led to residents trying to leave their chair and fall (Wagner et al., 2010). Facilitators on this level were not reported.

3.4.4. Social context level

Communication barriers we identified were: (1) poor information transfer among care providers and across shifts (Colon-Emeric et al., 2007, 2014; Wagner et al., 2010), as well as between staff and family (Wagner et al., 2010); (2) lack of care plan communication (Chapman and Newenhouse, 2013; Wagner et al., 2010); (3) failure to communicate falls (Wagner et al., 2010); (4) no carryover of training information (Resnick et al., 2004); and (5) tension and hostility between licensed and unlicensed staff (Wagner et al., 2010).

The absence of staff buy-in or accountability—most common when staff involvement was not sought in advance (i.e., top-down implementation)—was problematic (Etheridge et al., 2014; Resnick et al., 2004). The survey participants in the quantitative study by Chapman and Newenhouse stated that the following actions needed improvement: getting nursing assistants to contribute to fall prevention (54%), and getting staff to enact care plan changes quickly (65%) (Chapman and Newenhouse, 2013).

Additional social context barriers were leaders lacking quality improvement skills (e.g., made punitive statements when they provide staff with feedback concerning falls monitoring data, and thus supporting the "shame-and-blame" approach that is often predominant in nursing homes.) (Capezuti et al., 2007), who did not listen to or learned from staff, provide support (Chapman and Newenhouse, 2013), or supervised the implementation (Etheridge et al., 2014). Moreover, clinical leaders (i.e. falls coordinators) were frequently asked to assume other leadership roles (e.g., cover for nurse manager's absence), adding to their already high workload (Capezuti et al., 2007).

Communication that facilitated fall prevention included: (1) staff sharing information across shifts and disciplines (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2014; Resnick et al., 2004) and between staff and family (Wagner et al., 2010); (2) a fast and proper care plan communicating strategy to all staff to increase adherence (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2014; Wagner et al., 2010); (3) active listening, addressing communication weaknesses, and reporting improvements (Colon-Emeric et al., 2014); and (4) using diverse communication strategies (e.g., feedback, explaining and verifying meaning, open communication, pitching in and respecting ideas of others) (Colon-Emeric et al., 2014).

Also staff involvement and empowerment improved implementation. More empowered staff could take initiative (Colon-Emeric et al., 2007, 2014), better understand the rationale for recommended care (Colon-Emeric et al., 2007; Resnick et al., 2004), ask questions (Colon-Emeric et al., 2014), give opinions (Colon-Emeric et al., 2014), and take immediate action (Colon-Emeric et al., 2014).

Another facilitator regarding social context refers to collaboration and teamwork. In several studies, participants recognized the importance of including various disciplines with their diverse perspectives (Capezuti et al., 2007; Colon-Emeric et al., 2014; Wagner et al., 2010) and sharing responsibility for fall prevention (Colon-Emeric et al., 2014). Teamwork, a sense of community and staff cohesion was improved if diverse opinions were actively sought out, and the role of each discipline was better understood (Colon-Emeric et al., 2014; Wagner et al., 2010).

In addition, the presence of clinical leaders was seen as an advantage for implementation (Capezuti et al., 2007) and leaders who involved staff in the implementation process (Colon-Emeric et al., 2014; Resnick et al., 2004), who clearly explained the rationale for implementation (Resnick et al., 2004) and thus provided better support (Chapman and Newenhouse, 2013), facilitated implementation.

3.4.5. Organizational context level

The most frequently reported barriers for the organizational context level were too few staffing resources (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Resnick et al., 2004; Wagner et al., 2010; Williams et al., 2011) and lack of time (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Williams et al., 2011). These barriers made it harder to: (1) supervise, monitor, and assist residents (Williams et al., 2011); (2) systematically organize fall prevention meetings (Capezuti et al., 2007; Chapman and Newenhouse, 2013); and (3) complete assigned fall prevention tasks (Capezuti et al., 2007). Moreover, facilities often had a high turnover in staff with clinical and administrative functions (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Resnick et al., 2004) and made use of a floating pool staff (Resnick et al., 2004), which led to interruptions in carrying out fall prevention efforts. In addition, two papers reported that the lack of physical and occupational therapists as a barrier for fall prevention (Capezuti et al., 2007; Williams et al., 2011). If staff were forced to prioritize other tasks (e.g., state survey), fall prevention was postponed (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Etheridge et al., 2014).

Lack of equipment, education and training hindered implementation as well (Capezuti et al., 2007; Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Etheridge et al., 2014; Resnick et al., 2004; Wagner et al., 2010; Williams et al., 2011). For example, many facilities had insufficient computers (Capezuti et al., 2007; Colon-Emeric et al., 2007), or computers that were located in locked offices (Capezuti et al., 2007), or that were not accessible to all staff (i.e., accessible by registered staff only) (Wagner et al., 2010), which made data entry time-consuming (Capezuti et al., 2007). In addition, lacking an automated falls monitoring program (Capezuti et al., 2007), proactive fall prevention structures (Wagner et al., 2010; Williams et al., 2011), or regular fall meetings (Wagner et al., 2010) made implementation difficult.

Another barrier was the workload related to fall prevention (Resnick et al., 2004), struggling to sustain interventions (Resnick et al., 2004), and the related burden of documentation and paperwork (Colon-Emeric et al., 2007; Resnick et al., 2004). Coordinators often had insufficient time for this task, took over tasks not performed by staff members, or were perceived by staff as the sole person responsible for fall prevention (Capezuti et al., 2007).

By contrast, facilities with a strong interest (Capezuti et al., 2007) in fall prevention and who made it a priority (Chapman and Newenhouse, 2013), who focused solely on the implementation of one guideline at the time (Resnick et al., 2004), or who had sufficient equipment available (Chapman and Newenhouse, 2013; Colon-Emeric et al., 2007; Wagner et al., 2010) were more likely to succeed.

Educational structures increased training and knowledge standardization across facilities (Colon-Emeric et al., 2014; Wagner et al., 2010). In one study, staff felt more confident in recognizing fall risk factors and carrying out interventions after implementing an educational intervention (Colon-Emeric et al., 2014).

The following quality improvement structures, if incorporated into routine practice, were linked to better fall prevention: fall trends analysis (Chapman and Newenhouse, 2013); structure for developing a falls management plan for each resident (Chapman and Newenhouse, 2013); guideline-based standing orders (Colon-Emeric et al., 2007); and policy review, procedures, and documentation standards (Chapman and Newenhouse, 2013).

Resnick and colleagues (Resnick et al., 2004) reported that a coordinator to manage the implementation of the multiple components of fall prevention was valuable; preferably supported by a multidisciplinary team.

3.4.6. Economic and political context level

In the USA, often only registered staff has access to the care plan, as mandated by Health Insurance Portability and Accountability Act regulations (Colon-Emeric et al., 2007; Wagner et al., 2010). Consequently, it is harder to communicate changes in care plans to unregistered staff.

Another barrier was government reimbursement policies, resulting in meager involvement of in key disciplines (e.g., physiotherapists) in fall prevention (Capezuti et al., 2007).

Furthermore, corporate or state mandates that were initiated unexpectedly, this was perceived as an impediment for fall prevention implementation (Etheridge et al., 2014). However, in general, corporate or state mandates positively influenced implementation, especially when state surveys were conducted (Capezuti et al., 2007; Colon-Emeric et al., 2007).

4. Discussion

To the best of our knowledge, this is the first systematic review that synthesizes results on determinants of fall prevention implementation in residential care facilities. We performed an extensive search in a range of databases and identified 44 factors that influence implementation: 17 facilitators and 27 barriers. Within the thematic framework of Grol and colleagues (Grol and Grimshaw, 2003; Grol and Wensing, 2004), our results indicate that the social and organizational levels have the greatest number of influencing factors (9 and 14, respectively), whereas the resident and economical-political levels have the least (3 and 4, respectively). This suggests that especially organizational embedding of fall prevention is important. The most cited facilitators were good communication and facility equipment availability, while the most cited barriers were staff feeling helpless, frustrated, and concerned about their ability to control fall management, being overwhelmed by the excess protocols and training required, staffing issues, limited knowledge and skills, and poor communication. In our opinion, the following factors are the most essential and changeable key components to focus on for successful implementation: communication, knowledge, and skills. These factors are needed when implementing a complex intervention such as fall prevention, because this requires that correct information about resident health status, risk factors and behaviors be available to various team members and disciplines in order to develop and evaluate a clear care plan (Becker and Rapp, 2010; Colon-Emeric et al., 2013). Although, two previous reviews also discussed the importance of communication for successful fall prevention, research findings on fall prevention communication remain scarce (Becker and Rapp, 2010; Neyens et al., 2011). Poor falls management skills—more specifically the inability to target the most important fall risk factors—was also an important barrier mentioned in the systematic review of Neyens and colleagues (Neyens et al., 2011).

In addition, to embed fall prevention in nursing homes implementation should not rely exclusively on staff behavior, but should take a whole system approach to understand behaviors in relation to individual capacities and limitations. A balance between safe organizational processes, environment and equipment design, and task behaviors is needed (Hignett and Wolf, 2016). Indeed, due to the complexity of the health care organizational culture and the complexity of falls and their required prevention strategies, the whole system approach (including the patients' perspective) can deliver an understanding and improvement of safety integration (Hignett et al., 2016). However, complex interventions are difficult to develop, evaluate, and implement. Therefore, the UK Medical Research Council (MRC) has developed a framework to systematically design, evaluate, and implement complex interventions (Craig et al., 2008).

Several overviews have been published on generic implementation determinants in health care (Fleuren et al., 2014; Flottorp et al., 2013). Flottorp and colleagues (Flottorp et al., 2013) developed a comprehensive checklist of 57 determinants. When one compares our results with the determinants on this checklist, it is striking that several were not reported in the literature we reviewed. For example, Flottorp and colleagues (Flottorp et al., 2013) reported in their systematic review the following factors: knowledge about own practice in relationship to the innovation, intention and motivation to adhere, and self-efficacy. There are four possible reasons for this apparent discrepancy. First, we identified only eight relevant articles with low to fair methodological quality, despite using an extensive search strategy in several of the most comprehensive medical literature databases. Second, all studies were conducted in North America, the results may not thoroughly reflect all barriers and facilitators that exist in residential care settings in other continents. Third, we could only include studies that investigated views of the residential care staff. Since our results showed that the staff often had low awareness and negative attitudes and beliefs, it could be that they failed to recognize other important determinants. Fourth, our research aim was to understand which factors influenced implementation outcomes with regard to fall prevention. We wanted to focus on original research aimed primarily or secondarily at fall prevention implementation barriers or facilitators. For that reason, we excluded efficacy RCTs or RCTs that reported barriers and facilitators only in the discussion section (e.g., RCTs that reported on intervention effectiveness but that did not investigate the determinants of successful or failed clinical implementation). We did not want to evaluate implementation interventions (e.g. approach by Neyens et al. (2011). Overall, at this point, the evidence on determinants for implementing fall prevention in residential care facilities is incomplete. More research is needed to identify determinants observed by researchers or focused on residents' perspectives. Analyses could, for example, be conducted as part of RCTs with regard to fall prevention (e.g. as process analyses) as

suggested in the UK Medical Research Council framework on complex interventions (Craig et al., 2008).

However, this systematic review—resulting in the aforementioned 17 facilitators and 27 barriers—is a good first step in untangling this complex problem and can guide the development of fall prevention implementation programs.

Looking at the long list of barriers identified in this review, it is notable that several are generic in nature (e.g., time and staffing issues) and not falls specific. Although these generic barriers are important and should not be ignored, it is difficult to change them. In addition, it should be noted that these generic barriers are often a mistaken belief for other underlying problems (e.g., communication, knowledge, or attitude), which are modifiable.

This review has several strengths, including that it is based on a systematic search strategy conducted in line with the Center for Reviews and Dissemination Handbook and reported according to the PRISMA guideline. Other strengths are that we used clear definitions and a theoretical framework to synthesize the results that is based on literature analyses and previous research to understanding the interaction of barriers and facilitators at multiple levels (Grol, 1997; Grol and Grimshaw, 2003; Grol and Wensing, 2004). Moreover, in contrast to most reviews that focused exclusively on barriers of fall prevention implementation, we also specifically sought to identify facilitators.

A number of methodological limitations warrant further mention. First, although the probability is low, we may have missed potential relevant studies as we did not search gray literature. Second, by using very strict inclusion and exclusion criteria, we excluded some interesting studies that investigated determinants in both residential care facilities and another setting. However, since we wanted to focus on barriers and facilitators specific to residential care facilities and those studies did not report results for residential care facilities separately, we had to exclude them to avoid confounding the results. Third, several included studies suffered from methodological shortcomings, as shown in Table 3. We did not take this low quality into account when analyzing and reporting the results. We urge our readers to take this low quality into account when interpreting the results.

In terms of clinical implications, implementation of interventions should focus on modifiable determinants such as communication, knowledge, and skills (Grimshaw et al., 2012; Grol and Grimshaw, 2003; Grol and Wensing, 2004). Residential care facilities seeking to improve fall prevention could use this systematic overview to identify and address their facility-specific challenges. It is necessary to perform a clear determinant analysis in their context and take into account their fall prevention policy in order to achieve successful implementation. It should be clear that change takes time and, a structured implementation plan with clear goals and priorities should be developed. Thus, fall prevention implementation in residential care facilities is complex and requires efforts focused on the proper modifiable factors (Baker et al., 2015, Flottorp et al., 2013; Grimshaw et al., 2012; Grol and Grimshaw, 2003). In order to identify potential fall prevention determinants, to understand the relationship between determinants, and to tailor effective implementation strategies, further research is needed. Therefore, fall prevention trials should include a thorough process evaluation to map the drivers of implementation success (e.g. by using the MRC framework to systematically design, evaluate, and implement complex interventions) (Craig et al., 2008). In addition, efforts to improve fall prevention should start with a thorough assessment of current fall prevention strategies used by different healthcare workers and identification of key determinants that have an impact on the implementation of these strategies.

5. Conclusion

This systematic review provides an overview of fall prevention barriers and facilitators based on the international literature and can be used to support future implementation in residential care facilities. Successful implementation depends on many factors on different healthcare levels. A better understanding of these factors and their effect on the implementation process is necessary. Effective fall prevention must consist of multifactorial interventions that target each resident's fall risk profile, and should be tailored to address context-specific barriers and put into action the identified facilitators (Cameron et al., 2012; Grimshaw et al., 2012; Lamb et al., 2011; Vlaeyen et al., 2015).

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Conflict of interest

None.

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